

CLAIMS

1. A device for closing a sheath removal hole formed in the wall of a blood vessel by laser welding, comprising welding laser generating means, means for transmitting the welding laser, and means for monitoring the position of an end of the welding laser transmitting means, wherein the welding laser is radiated when the end of the welding laser transmitting means is located in the vessel wall.
2. The device for closing a sheath removal hole according to Claim 1, wherein the welding laser is a laser capable of heating the vessel wall.
3. The device for closing a sheath removal hole according to Claim 2, wherein the welding laser is a continuous laser capable of heating the vessel wall.
4. The closing device sheath removal hole according to Claim 3, wherein the welding laser is selected from the group consisting of a semiconductor laser, a Nd:YAG laser, and a second harmonics of a Nd:YAG laser.
5. The closing device sheath removal hole according to any one of Claims 1 to 4, wherein the means for monitoring the position of an end of the welding laser transmitting means includes means for generating monitoring light, means for transmitting the monitoring light, and means for detecting backscattered light of the monitoring light, and wherein an end of the monitoring light transmitting means and the end of the welding laser transmitting means are located at the same position, the monitoring light that is light having a wavelength absorbable by substances present in blood is radiated, the backscattered light of the radiated monitoring light is detected, and the position of the end of the welding laser transmitting means is determined based on the intensity of the detected light.
6. The closing device sheath removal hole according to Claim 5, wherein in the means for monitoring the position of an end of the welding laser transmitting means, the monitoring light

is light having a wavelength absorbable by hemoglobin, and wherein it can be determined where the end of the welding laser transmitting means is located; in blood, in the vessel wall, or in a surrounding tissue of the blood vessel.

7. The closing device sheath removal hole according to Claim 6, the light having a wavelength absorbable by hemoglobin used to monitor the position of an end of the welding laser transmitting means is selected from the group consisting of a semiconductor laser having a wavelength of 810 nm, a He-Ne laser having a wavelength of 543 nm, and a second harmonics of Nd:YAG laser having a wavelength of 532 nm.

8. The closing device sheath removal hole according to any one of Claims 1 to 7, wherein the welding laser transmitting means and the monitoring light transmitting means are a common flexible transmitting means.

9. The closing device sheath removal hole according to Claim 8, wherein the flexible transmitting means is selected from the group consisting of a quartz glass fiber, a plastic fiber, and a hollow medical waveguide.

10. The closing device sheath removal hole according to any one of Claims 1 to 9, wherein the welding laser generating means and the monitoring light generating means are a common semiconductor laser or Nd:YAG laser second harmonics generator.

11. The sheath removal hole closing device according to any one of Claims 1 to 10, further comprising a means for supplying a welding laser energy absorbing pigment to the sheath removal hole.

12. The closing device sheath removal hole according to Claim 11, wherein the welding laser energy absorbing pigment is indocyanine green.

13. A control method for determining the position of an end of a light transmitting fiber and radiating a welding laser through the light transmitting fiber onto the wall of a blood vessel in which a sheath removal hole is formed, in order to close the sheath removal hole by laser welding, comprising the steps of:

(a) radiating weak light used for determining a surrounding tissue through the light transmitting fiber inserted in the sheath inserted in the blood vessel, the fiber connected with a light generator;

(b) measuring backscattered light of the radiated weak light by a detector;

(c) determining a tissue surrounding the end of the light transmitting fiber; and

(d) radiating welding laser if it is determined that the tissue surrounding the end of the light transmitting fiber is the vessel wall.

14. A device for monitoring the position of an end of monitoring light transmitting means, comprising means for generating monitoring light, means for transmitting the monitoring light, and means for detecting backscattered light of the monitoring light, wherein the monitoring light that is light having a wavelength absorbable by substances present in blood is radiated, the backscattered light of the radiated monitoring light is detected, and the position of the end of the monitoring light transmitting means is determined based on the intensity of the detected light.

15. The device for monitoring the position of an end of a monitoring light transmitting means according to Claim 14, wherein in means for monitoring the position of an end of the monitoring light transmitting means, the monitoring light is light having a wavelength absorbable by hemoglobin, and wherein it can be determined where the end of the monitoring light transmitting means is located; in blood, in the vessel wall, or in a surrounding tissue of the blood vessel

16. The device for monitoring the position of an end of a monitoring light transmitting means according to Claim 14 or 15, the light having a wavelength absorbable by hemoglobin

used to monitor the position of an end of the monitoring light transmitting means is selected from the group consisting of a semiconductor laser having a wavelength of 810 nm, a He-Ne laser having a wavelength of 543 nm, and a second harmonics of Nd:YAG laser having a wavelength of 532 nm.